

ELMIDAE OF TAIWAN PART I: TWO NEW SPECIES OF THE GENUS *STENELMIS* (COLEOPTERA: DRYOPOIDEA) WITH NOTES ON THE GROUP OF *STENELMIS HISAMATSUI*¹

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ABSTRACT: Two new species of Elmidae: *Stenelmis wongi* and *Stenelmis formosana*, belonging to the group of *Stenelmis hisamatsui*, are described and illustrated. Descriptions of their habitats and ecological information are also included. A key and checklist to the species of *hisamatsui* group are given.

Elmidae is one of the major components in stream coleopteran fauna. More than 120 genera and about 1200 species are known from the world.

Most of the genera of Elmidae are endemic. In fact, not any genus can be considered truly cosmopolitan. *Stenelmis* is the elmid genus most nearly cosmopolitan and with the largest number of species. There are 146 species known from the whole world except Neotropical Region (Brown, 1981). *Stenelmis sauteri* Kôno 1936 is the only recorded species of this genus from Taiwan. The authors obtained this species from the neighborhood of its type locality. However, it is more similar morphologically to genus *Ordobrevia* than to *Stenelmis*. Its status will be discussed in another paper. Two new species of *Stenelmis* from Taiwan, belonging to *hisamatsui* group, are reported in this paper.

MATERIALS AND METHODS

The elmid materials available for this study were collected since 1987 by the authors and their colleagues from the laboratory of Insect Conservation of the Department of Plant Pathology and Entomology, N.T.U. The samples were captured by the modified Surber net sampler (50 cm x 50 cm x 50 cm), D-frame aquatic net (diameter 39 cm, depth 47 cm), and light trap.

The measurements used in the article are shown in Fig. 1. Coloration was observed under a white light source, and the specimens were deposited in 75% ethanol. The type specimens are preserved in 75% ethanol with a little glycerol.

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The following abbreviations are used for depository institutions:

- EMNTU Entomological Museum of National Taiwan University, Taipei, Taiwan, R.O.C.
NMW Naturhistorisches Museum Wien, Austria
NMNH National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A.
OMNH Oklahoma Museum of Natural History, University of Oklahoma, Norman, U.S.A.
TARI Department of Applied Zoology, Taiwan Agricultural Research Institute, Taichung, Taiwan, R.O.C.

Stenelmis Dufour s. lat.

Stenelmis Dufour, 1835: 158.

Type species: *Elmis canaliculata* Gyllenhal

Characterization - Adult: Body elongate, subparallel, moderately convex and finely pubescent dorsally. Body length 2-4 mm. Head globose, retractable within prothorax. Antennae slender, each 11-segmented. Maxillary palpi with apical segment oval and often largest. Pronotum with median longitudinal groove and sublateral carinae or lateral tuberculi, but without transverse impression. Elytra elongate and subparallel, each bearing 8 punctate striae, with or without accessory striae; humeri not very prominent; lateral margins serrate; epipleura extending to near apex of elytron; apices rounded and often converged at apex. Venter and legs except tarsi covered with plastron setae. Granules on venter and legs round. Prosternum occupies about 2/3 area of prothorax from ventral view; anterior portion deflected to permit retraction of head; lateral sides sinuate. Procoxae, mesocoxae and metacoxae moderately broadly separated. Mesosternum with a anteromedian excavation to accommodate prosternal process. 1st and 2nd visible abdominal sterna normal or with shallow impression on disk; the first three sterna with conspicuous lateral teeth attaching to epipleura. Protibiae without a fringe of hairy tomentum on the inner margin. Tarsi 5-segmented, tarsal claws with or without basal teeth. Male genitalia elongate, moderately broad; median lobe longer than parameres and usually longer than basal piece which is asymmetric.

The species occurs commonly in streams, lakes or ponds (Sanderson, 1953). Adults are positively phototactic and can be attracted by light traps during flight periods occurring from summer to autumn (Seagle, 1980).

Group of *Stenelmis hisamatsui*

Characterization: Body length 2.2-3.1 mm in known species. Color reddish brown to black. Interspace between pronotal longitudinal groove and sublateral carinae irregularly undulated. Elytra without accessory stria. Prosternal process subparallel, with round or slightly emarginated apex. The first two visible abdominal sterna impressed shallowly on disk and with carinae laterally beside the impression. Legs stout, hind tibiae of males more strongly curved, and with serial denticulations on inner side from basal 1/4 to apices; hind tibiae of females normal and with inside smooth. Apicoventral margin of tarsomere 5 with an elongate rounded process; tarsal claws without basal claws. Male genitalia with a closely pubescent projection on each paramere at about apical 1/5 dorsally.

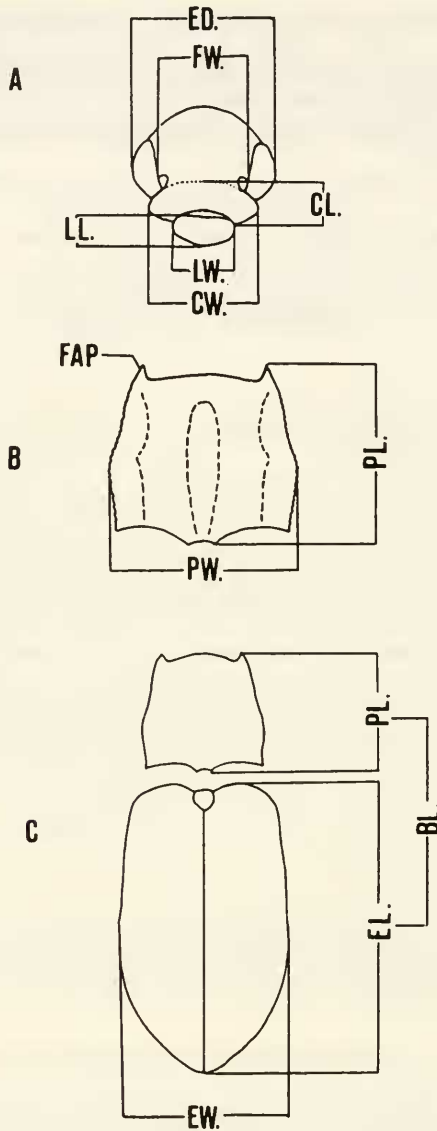


Figure 1. Morphological terminology: A. head; B. pronotum; C. pronotum and elytra. FW.: width of frons; ED.: distance across eyes; CW.: width of clypeus; CL.: length of clypeus; LW.: width of labrum; LL.: length of labrum; PW.: width of pronotum; PL.: length of pronotum; FAP.: frontal angle of pronotum; EL.: length of elytron; EW.: width of elytra; BW.: width of body (EW. = BW.); BL.: length of body (BL. = PL. + EL.).

Type species: *Stenelmis hisamatsui* Satô, 1960

Nomura first mentioned this group, including 6 species serially distributed from Japan to Southeast Asia in his letter to Satô (Satô, 1964b). But he did not define the group. This group now, at least, contains 7 species including 2 new Taiwanese species: *Stenelmis formosana* sp. nov. and *Stenelmis wongi* sp. nov. *S. birmanica* Grouve., another species in this group according to Nomura, is ignored here because of insufficient morphological data. A distribution map is shown in Fig. 8. It is clear that these species are distributed around mainland China and we infer that they split from a common ancestor distributed in China. It is a pity that we still do not know this ancestor since the study about elmids of mainland China is not complete. On the other hand, four species: *S. aritai* Satô, *S. ishiharai* Satô, *S. formosana* sp. nov., and *S. wongi* sp. nov. are more similar morphologically than the other members of the group. In addition, their distributions (the first two in Sakishima Is. and the other two in Taiwan) are very close. We suspect that they may have had a recent ancestor living in this area while land bridges existed between these islands during glacial periods of the Pleistocene epoch. Speciation among these four species occurred after these islands and Taiwan were isolated when glacial periods finished, and they may have diverged later than the other species in this group.

The following key, partially based upon characters extracted from the literature, is presented to separate species in this group.

Key to the adults of the *S. hisamatsui* species group

1. Frontal angles of pronotum truncate laterally; middle tibiae of male with serial denticulations on inner side ----- *metatibialis* (Vietnam)
Frontal angles of pronotum not truncate laterally; middle tibiae of male without serial denticulations on inner side ----- 2
2. Body size 2.4-2.8 mm ----- 4
Body size smaller or larger ----- 3
3. Body size smaller (under 2.4 mm) ----- *hisamatsui* (Ryukyu)
Body size larger (above 2.8 mm) ----- *nipponica* (Japan)
4. Pronotum bi-sinuate laterally; narrowest at apical 2/5; prosternal process with apex round ----- *ishiharai* (Ryukyu)
Pronotum less sinuate laterally, broadest at basal 1/3 and thence gradually narrowed anteriorly; prosternal process with apex mostly emarginate ----- 5
5. Surface of pronotum somewhat densely granulate (Fig. 5); frontal angles of pronotum less than 60° ----- *formosana* (Taiwan)
Surface of pronotum sparsely granulate (Fig. 4); frontal angles of pronotum more than 60° ----- 6
6. Granules on pronotum finer than those on head; frontal angles with apex dully pointed ----- *aritai* (Ryukyu)
Granules on pronotum not finer than those on head; frontal angles with apex somewhat sharp (Fig. 4) ----- *wongi* (Taiwan)

Stenelmis wongi, sp. nov.

Fig. 2, 4, 6

Body length (PL. + EL.): 2.5-2.8 mm, width (EW.): 1.0-1.1 mm.

Coloration: Reddish brown to dark brown, ventral surface lighter; covered with black granules throughout all the body and legs (except tarsi); epicranium dark brown except occiput lighter; antennae, mouthparts, tarsi and genitalia translucently yellowish brown.

Head (Fig. 2E): Subparallel behind eyes from dorsal view; vertex and occiput retractable within pronotal collar; cuticle covered with granules, on clypeus and frons denser than elsewhere; labrum, clypeus, and frons rather finely punctate; labrum subrectangular, about 2 times broader than long, but looks like long elliptic when retracted in clypeus; clypeus moderately convex in center, lateral margins round; ratio of length between clypeus and labrum (CL.:LL.) about 1.3; of width about 1.7; frontoclypeal suture not distinct; eyes round, width across the eyes (ED.) about 1.6 times as broad as frons width (FW.); surface of antennae reticulate under SEM, and with sparse sensory hairs apically, the first segment dilated and distal one strongly pointed at apex; the ratios of segments (1-11) are: 1.0 : 0.6 : 0.6 : 0.5 : 0.5 : 0.6 : 0.7 : 0.8 : 0.7 : 0.8 : 1.3.

Pronotum (Fig. 2E, F): Subquadrate as seen from above; slightly broader than long by about 1.2 times; widest at basal 2/5; base about 1.3 times as broad as apex; lateral side crenulate but not distinctly sinuate; frontal angle conspicuous, about 75° by dorsal view; about 85° by basal angle; surface coarsely granulated, more densely in lateral sides of median longitudinal groove and sublateral carina area, but very sparsely in median groove; median longitudinal groove more deeply impressed at center of pronotum, extending from base to apical 1/6; sublateral carina convex, sinuate, extending from base to apical 1/7; two small round deep depressions beside base of median groove. Scutellum subpentagonal, granulated sparsely.

Elytra: about 1.7 times as long as broad, wider than pronotum by about 1.2 times, broadest at about apical 1/3; lateral sides subparallel anteriorly and tapering arcuately posteriorly to round apex; lateral margins finely serrate; surface covered with minute and close granules and fine pubescence; each elytron bearing 8 complete punctate striae, strial punctures on disk rather large, deep, subcircular, and separated from one another by less than their own diameters, but becoming smaller and more shallow posteriorly; strial intervals with one or two irregular rows of coarse granules, slightly elevated, the 5th one narrowly carinate from humerus to apical 1/9; epipleura (Fig. 2J) narrowed gradually from basal 2/5 to apex.

Prosternum: Prosternal process (Fig. 2G.) with sparser and larger granules than on anterior portion, margins elevated, slightly expanded posteriorly, apex round or moderately emarginated.

Mesosternum: Coarsely granulate; hind angle (Fig. 2H) beside mesocoxal cavity with apex sharp.

Metasternum: (Fig. 6): Coarsely and sparsely granulated, median impressed line distinct, extending from posterior margin to anterior 1/4; transverse metasternal suture distinct.

Abdomen: Surface coarsely granulated on first visible sternum and progressively less coarse posteriorly, but on disk sparser than on lateral area; the 5th sternum (Fig. 2I) sinuate laterally and slightly emarginate at apex in both sexes.

Legs: Closely granulate except on tarsi; tibiae subequal to femora, and with small apical spurs; hind tibia (Fig. 2K) of male distinctly dilated at basal 1/3 on inner side; tarsi 5-segmented, last segment longer than others; the first four segments each with a short apical tuft of setae on ventral side; tarsal claws large, without basal teeth.

Male genitalia: (Fig. 2A, B, C): convex dorsally; median lobe about 1.2 times as long as

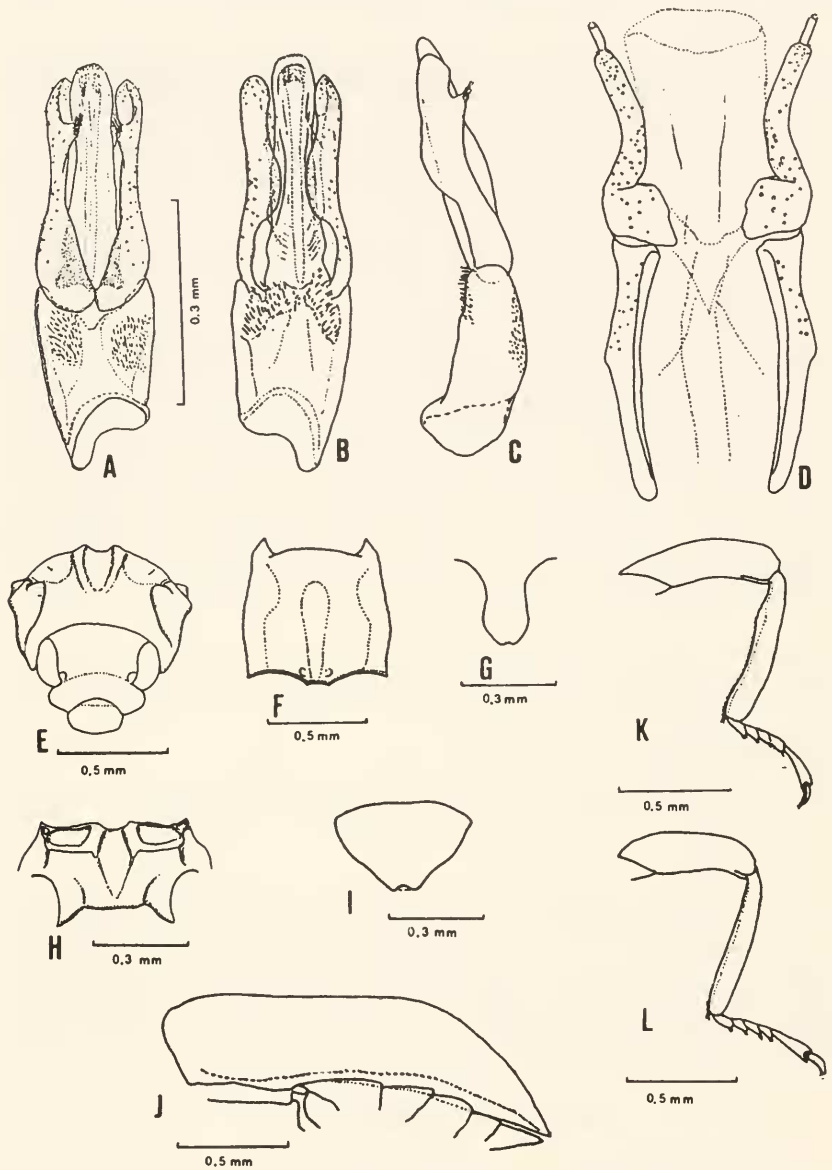


Figure 2. *Stenelmis wongi* n. sp.: A. male genitalia (dorsal view); B. ditto (ventral view); C. ditto (left lateral view) D. female genitalia (ventral view); A-D are drawn to same scale; E. head and pronotum (frontal view); F. pronotum (dorsal view); G. prosternal process; H. mesosternum (ventral view); I. the 5th abdominal sternum (♀); J. elytron (lateral view); K. hind leg (♂); L. hind leg (♀).

basal piece, expanding posteriorly; paramere with many setae at apex and median portion, shorter than median lobe, with a dorsal, densely pubescent tooth or projection at apical 1/6 of paramere, and expanded medially at apical 2/3 ventrally; basal piece asymmetric, convex dorsally, with close pubescence on dorsal and ventral surface.

Female: Body size larger than male in general (male 2.5-2.6 mm; female 2.6-2.8 mm in our material); hind tibia more slender and not dilated on inner side (Fig. 2L); genitalia as in Fig. 2D.

Variations: Color of young adults is lighter than the older ones (Maybe the old adults' surface is dirty and looks darker than the young.). The prosternal process is not emarginated apically in local population of Nuannuan, Keelung city. Frontal angles of pronotum ranged from 60° - 83°, mean \pm SD = 73° \pm 7 (n = 30).

Specimens examined: Holotype σ , Keelung city, Nuannuan, 20-VIII-1990, Jeng M.L. leg.. Paratypes: 3 $\sigma\sigma$, 4 ♀♀ , same data as holotype; 2 $\sigma\sigma$, Taipei Hsien, Pinglin, 21-VI-1989, Wong K.C., Jeng M.L., and Hsieh S.H. leg.; 1 ♀ , Taipei Hsien, Pinglin, 22-XI-1989, Wong K.C. leg.; 2 $\sigma\sigma$, 4 ♀♀ , Taipei Hsien, Pinglin, 26-VIII-1986, Wong K.C. and Hsieh S.H. leg.; 1 ♀ , Taipei Hsien, Pinglin, 19-II-1990, Wong K.C. and Lee C.W. leg.; 1 ♀ , Taipei Hsien, Pinglin, 7-VII-1989, Wong K.C. leg.; 2 ♀♀ , Taipei Hsien, Tongho, 28, 29-VIII-1989, Wong K.C. leg.; 2 ♀♀ , Taipei Hsien, Tongho, 28, 29-VIII-1989, Wong K.C. and Jeng M.L. leg.; 1 ♀ , Ilan Hsien, Chaoshih, 16-XII-1989, Jeng M.L. leg.; 1 ♀ , Taipei city, Waishung-shi, 27-VIII-1987, Wong K.C. leg.; 1 ♀ , Taipei Hsien, Wulai, 27-VIII-1990, Jeng M.L. leg.; 3 ♀♀ , Taipei Hsien, Sanshah, 13-VIII-1990, Jeng M.L. leg.; 1 ♀ , Sanshah, 14-X-1990, Jeng M.L. leg.; 3 ♀♀ , Taipei Hsien, Teng-liao, 20-X-1990, Jeng M.L. leg.; 2 $\sigma\sigma$, Taoyuan Hsien, Dashi, 6, 7-XII-1990, Hsu I.S. leg.. Most of the specimens were captured by modified Surber net sampler and D-frame water net, and the last collection data were by mercury lamp light trap.

Holotype and some paratypes are deposited in EMNTU; other type series will be deposited in NMW, NMNH, OMNH, TARI, and Dr. M. Satō's collection, Nagoya, Japan.

Etymology: The specific name is in honor of Mr. K.C. Wong who gave us so much help in many ways.

Diagnosis: This species is closely related to *Stenelmis aritai* from Ryukyu archipelago. These can be separated from each other by characters in the key.

Distribution and habitats: This species is distributed in north Taiwan as shown in Fig. 9. Most of the localities are branches of Tamsui River. These habitats are all the upstreams and are often the shaded stream in the forest. Their elevations are lower than 500 m. Most of the type series were collected from gravels and pebbles in shallow riffles in the stream like the microhabitats of *Zaitzevia* species. A few were taken from cobbles. All of the habitats have minimum pollution.

Stenelmis formosana sp. nov.

Fig. 3, 5, 7

Body length (PL. + EL.): 2.4-2.8 mm, width (EW.): 1.0-1.1 mm.

Coloration: Reddish brown to dark brown dorsally, pronotum and central line of elytra lighter in newly emerged specimens; ventral surface lighter; body surface covered with dark granules; appendages of head, tarsi and genitalia translucently yellowish brown.

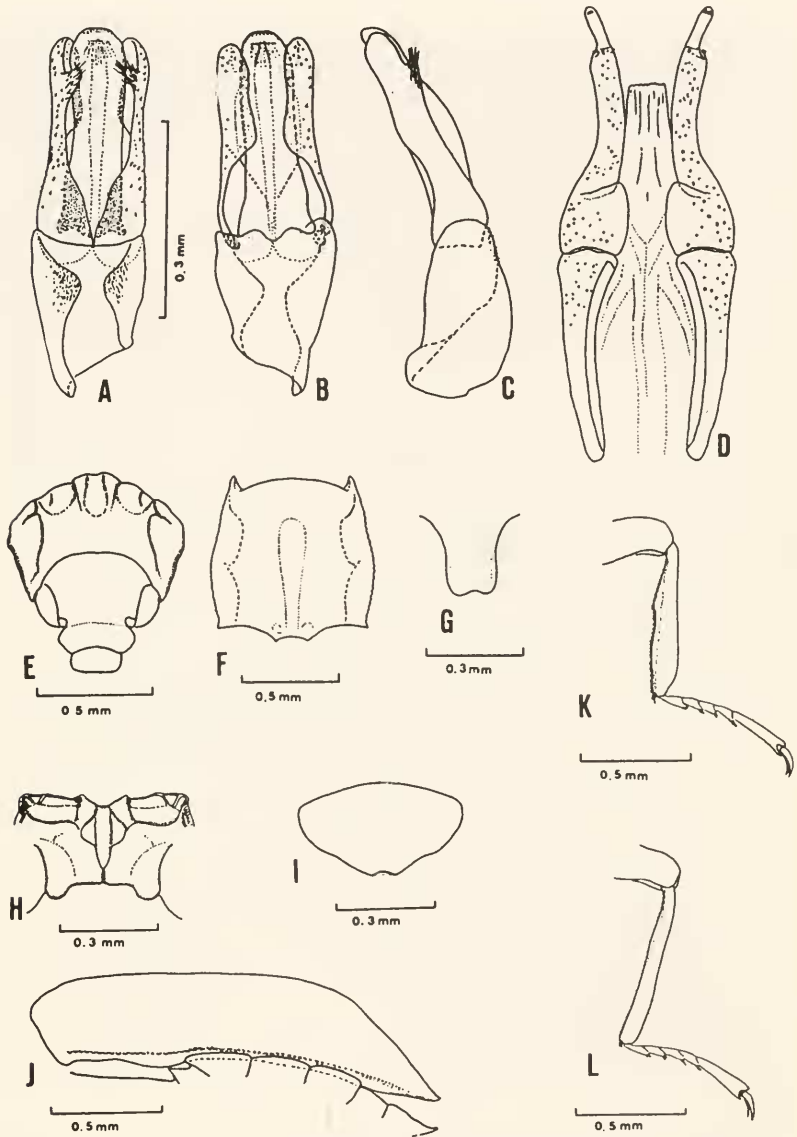


Figure 3. *Stenelmis formosana* n. sp.: A. male genitalia (dorsal view); B. ditto (ventral); C. ditto (left lateral view); D. female genitalia (ventral view); A-D are drawn to same scale; E. head and pronotum (frontal view); F. pronotum (dorsal view); G. prosternal process; H. mesosternum (ventral view); I. the 5th abdominal sternum (♀); J. elytron (lateral view); K. hind leg (♂); L. hind leg (♀).

Head (Fig. 3E): Subparallel behind eyes from dorsal view; distance across eyes broadest; labrum subrectangular, about 2 times as broad as long, but looks like long elliptic when retracted in clypeus; clypeus broader than labrum by 1.5 times; eyes slightly prominent, distance across eyes (ED.) about 1.6 times as broad as frons (FW.); antenna 11-segmented, with sensory hairs apically, the first segment dilated and distal one strongly pointed at apex; the ratios of segments (1-11) are: 1.0 : 0.7 : 0.6 : 0.5 : 0.4 : 0.6 : 0.5 : 0.6 : 0.7 : 0.7 : 1.1.

Pronotum (Fig. 3E, F): Slightly broader than long by about 1.1 times; widest at basal 1/3; base about 1.3 times as broad as apex; lateral side crenulate, round or slightly sinuate; lateral angle conspicuous, about 45° in dorsal view; about 85° to 90° by basal angle; surface somewhat densely granulated, more densely in lateral sides of median longitudinal groove and sublateral carina area, but very sparsely in median groove; median longitudinal groove extending from base to apical 1/5, groove more deeply impressed at central pronotum; sublateral carina convex, sinuate, extending from base to apical 1/6; two small round depressions besides the base of median groove. Scutellum subpentagonal, granulated sparsely.

Elytra: About 1.8 times as long as broad, 1.3 times broader than pronotum, broadest at about apical 1/3; thence subparallel anteriorly and tapering arcuately posteriorly to round apex; lateral margins finely serrate; surface covered with minute and close granules and fine pubescence; punctures on disk rather large, deep, subcircular, and separated from one another by equal or slightly less than their own diameters, but becoming smaller and more shallow posteriorly; stria intervals with one or two irregular rows of coarse granules, slightly elevated, the 5th stria interval narrowly carinated from humerus to near apex; epipleura (Fig. 3J) narrowed gradually from basal 2/5 to apex.

Prosternum: Prosternal process (Fig. 3G.) with larger and sparser granules than on anterior deflect portion, margins elevated, lateral sides subparallel or slightly expanded posteriorly, apex moderately emarginate.

Mesosternum (Fig. 3I): Apex of hind angle beside mesocoxal cavities bluntly rounded.

Metasternum (Fig. 7): More coarsely and closely granulated than the preceding species; median impressed line distinct and complete; transverse metasternal suture distinct.

Abdomen: Surface coarsely granulate on first visible sternum and progressively less coarse posteriorly, but on disk sparser than on lateral area; the 5th sternum (Fig. 3I) sinuated laterally and slightly emarginate at apex in both sexes.

Legs: Closely granulate except on tarsi; tibiae with small apical spurs; hind tibia of male (Fig. 3K) distinctly dilated at basal 1/3 on inner side; distal tarsal segment longer than others; the first four segments each with a short apical tuft of setae ventrally; the apex of last segment with a process ventrally; tarsal claws without basal teeth.

Male genitalia (Fig. 3A, B, C): Median lobe expanded posteriorly, about 1.3 times as long as basal piece; paramere shorter than median lobe, with bluntly rounded apex, and with a dorsal pubescent tooth or projection at apical 1/5, and bearing many fine setae at apex and median portion; basal piece asymmetric, each side provided with close pubescence ventrally at base.

Female: Body size usually larger than male (male 2.4-2.6 mm; female 2.5-2.8 mm); hind tibia (Fig. 3L) more slender and not dilated on inner side; genitalia as in Fig. 3D.

Variations: Color of newly emergent adults collected by light trap is lighter than the older ones; prosternal process sometimes asymmetric at apex; the frontal angle of pronotum ranged from 30° to 60°, mean \pm SE = 45° \pm 5° (n = 30).

Specimens examined: Holotype male, Taipei city, Waishung-shi, 20-VI-1987, Wong K.C. leg.; paratypes: the same locality and collector as holotype: 7 adults, 25-VII-1987; 5 adults, 28-VIII-1987; 3 adults, 17-IX-1987; 1 adult, 4-X-1987; 5 adults, 18-X-1987; 1 adult, 8-XI-1987; 1 adult, 13-XII-1987; 1 adult, 28-V-1988; 11 adults, 20-VI-1988; 1 adult, 30-VII-1988;



Figure 4. *Stenelmis wongi* sp. nov.: ♂, dorsal view, younger adult.



Figure 5. *Stenelmis formosana* sp. nov.: ♂, dorsal view, younger adult.



Figure 6. Metasternum of *Stenelmis wongi* sp. nov.



Figure 7. Metasternum of *Stenelmis formosana* sp. nov.

2 adults, 27-VIII-1988; 3 adults, 19-I-1989, Jeng M.L. leg.; 3 adults, 28-VII-1990, Jeng M.L. leg.. The following paratypes were collected around Taiwan: 14 adults, Taipei Hsien, Sanji, 25-VII-1990, Jeng M.L. leg.; 6 adults, Taipei Hsien, Wanli, 13-VII-1990, Jeng M.L. leg.; 1 adult, Taipei Hsien, Wulai, 27-VI-1990, Jeng M.L. leg.; 1 adult, Taipei Hsien, Sanshah, 16-VII-1990, Jeng M.L. leg.; 2 adults, Taipei Hsien, Sanshah, 14-X-1990, Jeng M.L. and Lin Y.J. leg.; 11 adults, Taipei Hsien, Shungshi Shang, 11-VIII-1990, Jeng M.L. leg.; 2 adults, Taipei Hsien, Teng-liao, 20-X-1990, Jeng M.L. leg.; 26 adults, Taoyuan Hsien, Dashi, 27, 28-XI-1990, Hsu I.S. leg.; 1 adult, Nantou Hsien, Puli, 5-IX-1989, Jeng M.L. leg.; 4 adults, Chiayi Hsien, Fanlu, 9-IX-1989, Jeng M.L. leg.; 20 adults, Kaohshung Hsien, Liogwai, 26, 28-V-1989, Jeng M.L. leg.; 6 adults, Kaohshung Hsien, Shanping, Hsu I.S. leg.; 11 adults, Pintong Hsien, Suchung-shi, 21-I-1990, Jeng M.L. leg.; 2 adults, Pintong Hsien, Suchung-shi, 30-VII-1990, Jeng M.L. leg.; 2 adults, Pintong Hsien, Kenting, 14-VIII-1990, Chang S.J. leg.; 26 adults, Pintong Hsien, Shinjung, 22-I-1990, Jeng M.L. leg.; 10 adults, Taitong Hsien, Chulu, 21-VIII-1989, Jeng M.L. leg.; 89 adults, Taitong Hsien, Peiyuan, 11-VIII-1989, Luo T.G., Wong K.C. and Jeng M.L. leg.; 5 adults, Taitong Hsien, Chikwai-tsoo, 31-I-1991, Jeng M.L. leg.; 8 adults, Taitong Hsien, Chengkong, 12-VIII-1989, Jeng M.L. leg.; 22 adults, Hwalien Hsien, Shitsuo, 11-VIII-1989, Jeng M.L., Luo T.G. and Wong K.C. leg.; 8 adults, Hwalien Hsien, Fuhuan, 22-VIII-1989, Jeng M.L. leg.. Other specimens examined by Satô: 215 adults, Hwalien Hsien, Antong Spa, 12-VIII-1968, M. Nishikawa leg.

Holotype and some paratypes are deposited in EMNTU; other type series will be deposited in NMW, NMNH, OMNH, TARI, and Dr. M. Satô's collection, Nagoya, Japan.

Etymology: The specific name is derived from Taiwan because the species is widely distributed around Taiwan.

Diagnosis: This species is allied to *Stenelmis nipponica* Nomura, 1958 and *Stenelmis ishiharai* Satô, 1964; these can be separated by the key. This species is also similar to the preceding species, but the frontal angle of the pronotum is sharper and the granules of the metasternum are much denser than in *S. wongi* n. sp. (fig. 6, 7).

Distribution and habitats: This species is very common in lower altitude streams around Taiwan. The known localities are shown in Fig. 9. These streams are only slightly polluted. In contrast with *S. wongi*, the majority of the specimens were collected from cobbles, boulders, and blocks. Sometimes we found the adults clinging tenaciously to algae on submerged rocks in large numbers. These habitats are also favored microhabitats of *Grouvellinus* species. We think this species has greater tolerance limits to various pollutants.

Ecological Remarks: We have used light traps combining mercury lamp and black light to attract adults in the late summer. We obtained more females than males by the trap, and this is similar to American *Stenelmis* species (Seagle, 1980). Black light seems more effective than mercury lamp for attracting the species. Furthermore, we have observed that very few adults collected from the stream flew to fluorescent lamps when they were placed on dry land. We suspect that some adults have spent a bit of time under water before they began the flight period.

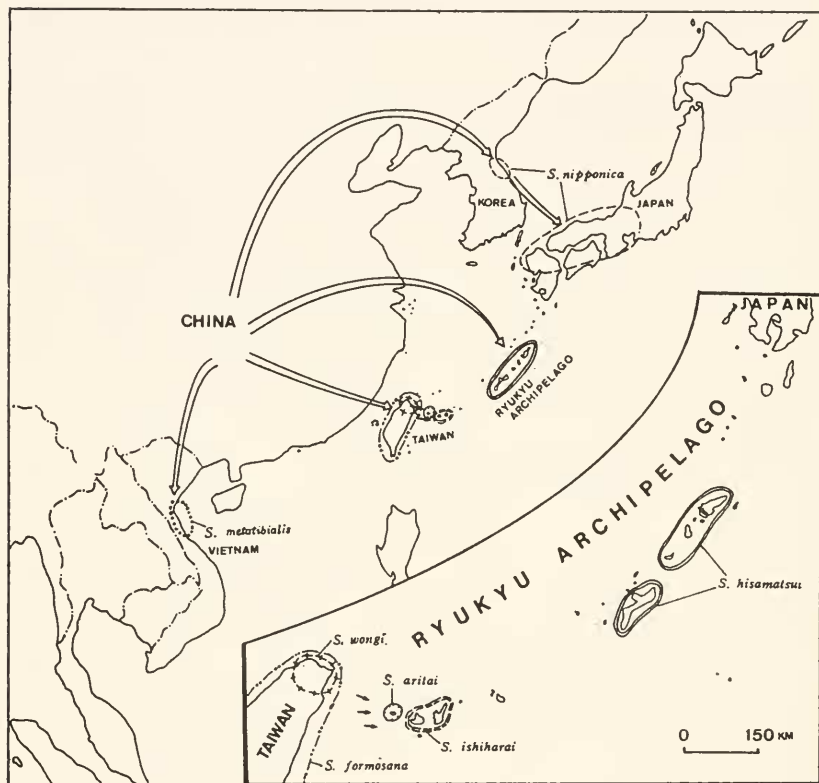


Figure 8. Distribution map of *Stenelmis hisamatsui*-group species. The arrows present the inferred pathways that the species of the group spread.

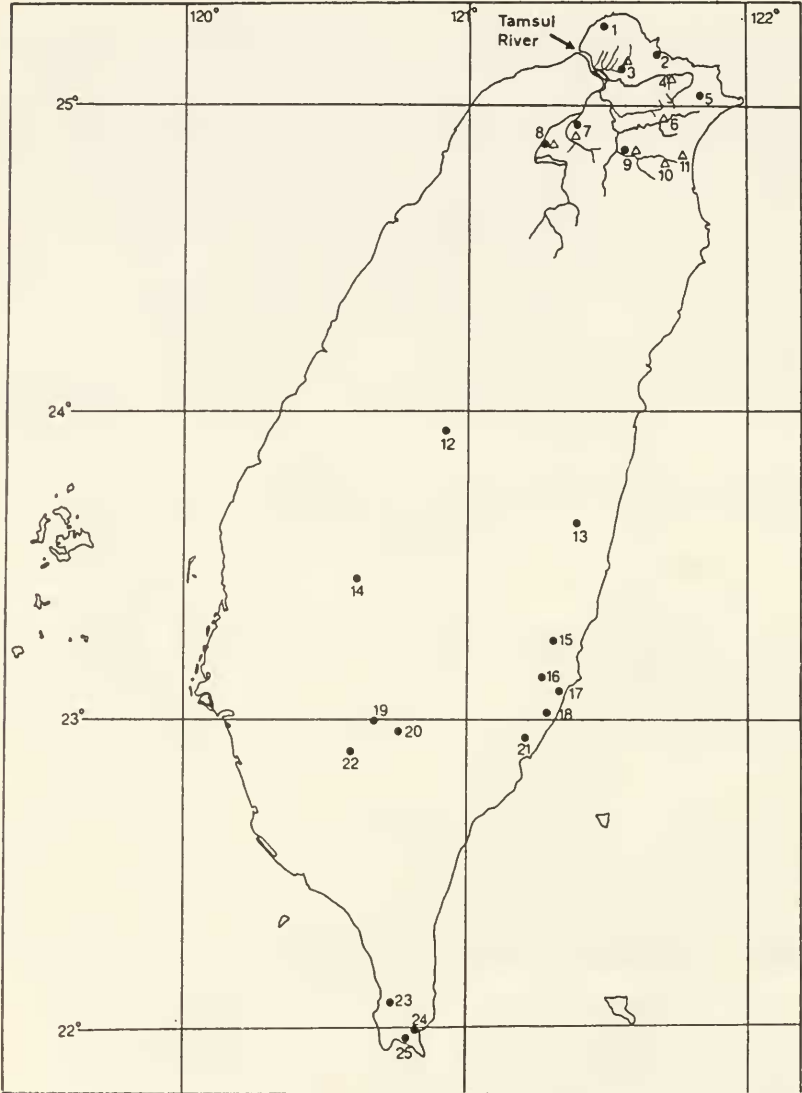


Figure 9. Distribution of *Stenelmis wongi* (Δ) and *Stenelmis formosana* (\bullet) on Taiwan. The collection sites are: 1. Sanji, 2. Wanli, 3. Waishung-shi, 4. Nuannuan, 5. Shungshi Shang, 6. Pinglin, 7. Sanshah, 8. Dashi, 9. Wulai, 10. Tongho, 11. Chiaoshi, 12. Puli, 13. Fuhyuan, 14. Fanlu, 15. Antong Spa, 16. Shitsuo, 17. Chengkong, 18. Peiyuan, 19. Liogwai, 20. Shanping, 21. Chikwai-tsoo, 22. Meinong, 23. Suchung-shi, 24. Shinjung (Kangko), 25. Kenting

Hinton (1976) stated that he never saw any elmids collected from streams or rivers attempt to fly, even when they were placed on dry land. This should be just a common condition but not absolute. Our observations support the statement of Brown (1987) that a fair number of light-trapped elmids have almost certainly spent time submerged in water before flying.

Checklist of the species of the group of *Stenelmis hisamatsui*

- aritai* M. Satô, 1964a, p. 32, no figure.
Holotype female in Dr. M. Satô's collections.
Male is unknown at the present time.
Distribution: Japan (Ryukyu: Sakishima Is.).
- formosana* Jeng and Yang, sp. nov.
as "*Stenelmis* sp." in Nomura's letter to Satô (Satô, 1964b)
Holotype male in EMNTU, Taiwan.
Distribution: Taiwan.
- hisamatsui* M. Satô, 1960, p. 253, Fig. 1, 2; maxillary palpus and male genitalia in Satô 1965, Fig. 4, 12; found in cave (Satô, 1964b); collected from Is. Guam (Satô, 1983, p. 41)
Holotype male in Dr. M. Satô's collections
Distribution: Japan (Ryukyu: Amami-Ôshima Is., Toku-no-shima Is., Okino-erabu-shima Is., Okinawa-honto), Guam.
- ishiharai* M. Satô, 1964, p. 31, no figure; male genitalia in Satô 1965, Fig. 11.
Holotype male in Dr. M. Satô's collections.
Distribution: Japan (Ryukyu: Sakishima Is.).
- metatibialis* Delève, 1968, p. 161, Fig. 21-23.
Monotype male in Musée Hongrois d'Historie Naturelle à Budapest.
Female is still unknown.
Distribution: Vietnam (Prov. Nghe-An).
- nipponica* Nomura, 1958, p. 41, Fig. 1.
Holotype male in Natural Science Museum, Tokyo, Japan.
Distribution: Japan (Honshu, Shikoku, Kyushu), Korea (Satô, 1978)
- wongi* Jeng and Yang, sp. nov.
Holotype male in EMNTU, Taiwan.
Distribution: north Taiwan.

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